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ANNIVERSARY ADDRESS, IOWA ACADEMY OF SCIENCE[1]

THERE is an old and familiar phrase which reads: "To all to whom these presents may come, greeting." I remember how in youthful days this phrase struck me as of peculiar mold and how, without perhaps realizing its antiquity or history, I puzzled as to its full significance and the conditions which, in some distant era, must have given it birth. We need not now attempt to trace its lineage or discover how ancient ambassadors or messengers may have used it in their visits to friend or foe, but I like to fancy for the moment that I am commissioned to bring to you on this anniversary occasion the greetings and congratulations of the world of science. Certain I am that such greetings and congratulations must extend from organized science in general and especially from all societies of similar scope.

Science is essentially mutualistic and the success of one organization is the gratification of all—the triumphs and discoveries of one are shared with the many and the feeling of pride in the progress of the one may be shared without loss by sister organizations. As the discovery made in one branch of science may be the necessary foundation for the solution of some problem in another, so the contribution from one society may be the stepping stone to advancement in another. It is all hail then, greetings and felicitation and Godspeed in the accomplishments of your future destiny.

The state academies of science, or socie-

[1] Delivered at the twenty-fifth anniversary meeting in Des Moines, Iowa, April 26, 1912.

ties of the scope of ours, are of comparatively recent origin, so that the achievements of the quarter century of activity and growth are well worthy of recognition. Such societies have their antecedents in the local academies formed by groups of scientific workers in various cities or limited communities, which again may doubtless be considered as an introduction from the old world, where academies of science under various names have been in active operation for a much longer period of time. Among the first and most notable which were organized in this country are the American Philosophical Society and the Academy of Natural Sciences of Philadelphia, the Brooklyn Academy of Arts and Sciences, the American Academy and the Boston Society of Natural History of Boston, and the St. Louis Academy of Science.

Such local societies were established for the association of scientific workers in centers containing a sufficient number to serve as a stimulus for such work and for a time at which ready communication between distant cities was not so convenient as at the present time. The organization of the state academies, however, seems to have occurred particularly in the central-western country and may be looked upon as resulting from the condition of scientific workers within the boundaries of these commonwealths. The scope of these academies has, however, taken on a somewhat different range, at least for many of them, since they have in many cases served as scientific advisers to the states in which they exist. This particular function of course makes the state boundary of special significance and is perhaps in itself a sufficient basis for the organization of such societies in every state. That very much can be accomplished by such a connection may be seen from the many different scientific activities which have been encouraged or stimulated by the societies or by the individual members under the incentive of associated work. For instance, the geological surveys, biological surveys, topographical surveys, and other enterprises dependent upon state support have in many cases had their origin and in many other cases received their support and encouragement from the state academies.

State academies exist in Wisconsin, Kansas, Iowa, Indiana, Minnesota, Nebraska, California, Ohio, Illinois, Michigan, Colorado, Utah, Oklahoma, Maryland and Tennessee. In some degree they measure the scientific activity of the states, naturally they should flourish in states of large area and less population where the isolation of scientific workers has been a special incentive to their organization. One of the first of these to be organized was the California Academy of Science, followed by the Maryland Academy and the Wisconsin Academy of Arts and Sciences, which latter seems to have been organized with distinct state faculties and state support from the start and with a remarkably full and valuable series of publications to its credit. While its scope is somewhat broader than some of the others so as to include historic and literary productions, so large a part of its work has centered on scientific problems of the state that it is to be counted one of the most fruitful of the state academies devoted to science.

The Kansas Academy of Science, organized in 1867, has been a very active society through all its career, and its reports published by the state constitute a most creditable contribution to the scientific papers of the state.

The Indiana Academy, organized 1885, and which celebrated its quarter-centennial with a notable meeting two years ago, has shown great activity, especially with reference to the problems of the state.

The Ohio Academy, with which I have been associated for a number of years, has enthusiastic annual meetings, publishes its own proceedings, has a research fund contributed by a friend, and has been instrumental in founding several projects of state-wide interest and importance. While its work has been mainly in biology and geology, its programs include papers on widely varied lines of study, and it has been of great service in promoting acquaintance and cordial feeling among the scientific workers of the state.

These few references to particular societies are given not because they are more important than others that might be named, but because they will serve to indicate the scope and sphere of the state organizations in science. They certainly amply justify the effort of the devoted members who have given so unstintedly of time and thought in the upbuilding of the societies and the enterprise they represent.

While the political boundaries of a state do not always best limit the activities of such a society, there is distinct reason for such sphere in the relation the academy may have to state problems of a scientific character. Such a society composed of representative students from various professions and positions may well constitute a useful advisory body for the legislative bodies in dealing with the problems requiring scientific attention, but in addition to this, the many problems that relate themselves naturally within state boundaries or can best be associated with public state enterprises, surveys, etc., give it a rational sphere. Perhaps the most emphatic basis, certainly one of the most forceful to the membership, is the opportunity for acquaintance, good fellowship and friendship among the workers in a common field. This alone would be ample reason for the time and effort given to the periodical meetings.

While these societies do not boast of monumental edifices, great pageantry or display, their place in the world of science is determined by the record of contribution to the world's knowledge and this recognition in their several spheres will be based on their service to the welfare of the communities in which they labor. That this service is a growing one and that its fruition in years to come will bring credit to all those who have labored in their promotion is, I believe, beyond doubt.

They are centers of research and research is the breath of life for science. New investigation and discovery are the essential to activity. This has been shown in every period of the world's history. Witness the stagnation of the middle ages, properly called the dark ages, when authority took the place of progressive research and the conquest of the unknown. As such centers of research the academies are factors in the advancement of learning, and so of the progress of the race. Every one is a force for betterment and speed the day when such forces are operative in every state of the nation.

Sometimes we may think there is an overproduction of scientific societies—especially when dues become payable—but while there may be some with no necessary mission, we can learn to discriminate and encourage those of merit. There is also, I think, less danger of degeneration in a number of fairly independent societies than in a too great centralization with the domination of small circles who happen to be in control.

This Iowa Academy was preceded by an earlier society, organized in 1875, and which held meetings up to 1884, when from the removal of some of its most active members and unfortunate disagreement be-

tween some of those remaining it ceased to exist. I recall, however, with much pleasure the meetings that I attended during the years 1876 to 1884, and the opportunity it afforded to become acquainted with the active scientific workers of the state. Professors Calvin, McBride and Hinrichs from the university, Todd from Tabor, Herrick from Grinnell, with Bessey, Fairchild and Macomber of Ames, Putnam of Davenport and Witter of Muscatine were among the active members in attendance at those meetings. It was at one of these early meetings (1876) that my first effort in the line of a scientific contribution was presented and while it appears to have been a very simple and crude affair it naturally marked an important step in my own interest in scientific work. I have always felt that it was regrettable that this earlier academy had to be abandoned, and it was not until after several sincere efforts to rejuvenate it that the conclusion was finally reached that this was impossible, and the only course left to organize on a new basis.

I shall not attempt here a review of the achievements of our academy. Time and the command of the details both forbid and this feature is to receive attention in another part of our program. I wish, however, to revert briefly to the early hopes of the society and to see in what degree its achievements have measured up to those early aspirations.

In the first annual address before the society, which I may confess here was delivered before a mere handful of scientific friends, I presented some ideas as to what I conceived to be the opportunity for the society and the lines of work desirable in the state. Digging up this buried and long-forgotten address, I have been interested to see in how many respects this forecast has been met and the ideas there advocated provided for in one way or another in the state's activities. Not that I would claim any special foresight or prophetic vision in the case nor that this address had any special weight in securing the results, but that it shows in some degree perhaps the sort of hopes and aspirations for which the members of the Academy stood in those early days.

For example, a geological survey was strongly urged and the organization which soon after followed and the splendid service of this survey to the state have amply justified the plea. A readjustment of the weather service was suggested and the successful combination of the state and government service which was accomplished a few years later and which has proved one of the most effective in the country, is our proof that the hope was not a vain one nor its accomplishment impracticable. The plea for a state museum for the preservation of our native fauna and flora has been met in part at least by the splendid start made in the collections gathered in the historical museum so ably organized by the lamented Charles Aldrich, and many phases of biological investigation have been provided for in the Experiment Station.

The academy volumes which have been published by the state for a number of years have become a distinct feature of the state's activities and are watched for eagerly each year. The record of achievement which they show embraces so many important facts concerning the natural history, geology and other scientific problems that the scientific literature of the state would seem meager without them.

One thing then urged and desired by many of the members seems not yet provided for, at least in fact, and that is a biological survey. This was included in the plan for a geological survey, and though it is specified in the act creating the survey

the actual attention to this phase of the work has been, as all must realize, a very minor matter. No more, I grant, than has been the case in most states where similar conditions exist; no more, perhaps, than seems necessary from the important problems pressing for solution along geological lines. I submit, however, that it is hardly the proper thing to get a survey established with the support of two bodies of workers and then devote all the resources to one line of work, and this condition prevails in far too many states where the so-called geological and natural history surveys are doing little or no biological work, and often that little as a purely gratuitous service from devoted workers.

Speaking now as an outsider and viewing the matter from a distance it appears to me that here is one enterprise that this academy might make one of its pet projects. If a thorough and systematic biological survey can not be pushed forward under the present organization so as to secure accurate knowledge as to the biological resources of the state, then let the biological workers get together to secure provision for the work under some other form of organization.

But I should remember that I have not been invited here to give advice and I am too well aware of the energy with which the Iowa people can advance the projects in which they believe to feel that advice is needed.

On such an occasion as this it seems almost a necessity to attempt some review of the progress made in the lines of work for which we stand, but in addressing myself to this task I am more than ever impressed with the rapidity of this progress and my inability to discuss it. This survey applies more especially to the last quarter century, as this is the period most familiar to me, and of which I can speak most intelligently.

So many principles of fundamental importance in science have been discovered or elucidated during the quarter century that it makes a pretty full record if one makes the attempt to compass it. Among those of especial interest are the determinations concerning the kinetic theory of matter, the progress concerning certain phases of the theory of evolution, the newer aspects of the theories for cosmic evolution, the application of Mendel's law in the problems of heredity, the atomic theory of electricity, and of course numerous others which we can not stop to mention. In some of these there has been such a complete change of view that one who goes back to his school science of a quarter century ago must feel quite lost in the light of new discoveries or imagine himself to have been unconscious for a period and waked up in a new era.

There is perhaps no field or phase of science in which the change of attitude has been more prominent than in the application of science to the problems of every-day life. Science and human welfare, as represented in industry, in public health and sanitation, in the betterment of social conditions, are being linked closer and closer together and the progress in the past quarter century has been more rapid than in any other period of the world's history.

To review the different branches of applied science and to show the details of progress in each would be an impossible task for one person in a brief address and, moreover, much of it is an oft-repeated and familiar tale. We all know something of the marvelous strides in medicine and surgery, one of the most conspicuous fields of science in relation to human welfare, though I doubt if any of us outside the body of active workers in this particular field realize the revolutionary changes that have taken place in surgical methods and therapeutic agencies as a result of the ap-

plication of scientific discoveries in the realm of physiology and biology. Bacteriology alone, which has had practically its entire development within the quarter century, has changed the whole basis of treatment in hosts of diseases and given an entirely new foundation for preventive medicine and sanitation. Still more recently protozoology has entered the field with a present record of many most serious diseases determined as of protozoan basis, and a promise of solution for many more that have baffled medical science for centuries.

In the field of industry the changes of the quarter century have been so enormous as to defy description, at least by one who has not followed the growth in detail. A complete metamorphosis, as a biologist might say, has occurred in many trades and manufacturing industries and practically all based on scientific discoveries and applications. Chemistry, physics, mechanics, biology, geology and other branches of science have contributed their share in this evolution.

In agriculture we see this process at present in one of its most active periods and we can only predict from rapidity of change what the future may bring. Enough, perhaps, to say that production is to be still further accelerated, farm conditions, both for greater production and better living, immeasurably improved and the basis of support for a denser population enlarged. Here, as in medicine, botany, zoology and bacteriology are playing a most important part.

Linked to these phases of human activity in most important manner is the problem of transportation, an activity perhaps more typical of the modern spirit than any other. Locomotion by water, by land and now by air, has been accelerated in a marvelous degree in the quarter century just passed. Twenty years ago I stood in a street in this city of Des Moines and watched a street parade, the most interesting feature of which, to me at least, was a horseless carriage driven by electricity, one of the very few up to that time that had actually been made to work. And for a number of years after that the automobile was in a strictly experimental stage. Now, well it is entirely unnecessary to mention motor boats or motor vehicles or even flying machines as of doubtful accomplishment. I doubt, however, if we fully realize the immense changes produced in our social status by the progress in rapid transit on water or on land for the last few years. As for the place of aerial navigation, that is yet to appear, but I have no doubt as to its practical application in human affairs. It can not displace present modes of travel or transportation, but will, I have no doubt, create a class of service for itself and doubtless one which will have a profound influence on human welfare.

Closely linked again is the question of rapid communication. Foreshadowed by the telegraph, electrical science has in recent years given us the telephone and the wireless as accomplished facts in communication, regardless of time and space. Thirty years ago, when the first commercial lines of telephone were being connected up, it was still looked upon largely as a toy. Very few, even of its most ardent promoters probably, had any conception of how it would alter the conditions of human life, or revolutionize methods of commerce and the relation of social centers, or of city to country. So swiftly and quietly has this come that I doubt if we fully realize the significance of it all. While there still remains to those of us who saw it come some remnant of wonder at the phenomenon, the coming generation

accept it as a matter of course and chatter through the telephone apparently oblivious of the marvelous scientific achievement which put it at their service.

And so we might go on with other achievements of the recent years, the cotton picker, the trolley car, the gas engine, long-distance transmission of power and the moving picture, all of which would have been impossible but for scientific discoveries and their application. I desire, however, to take a little time for the achievements in my own more special field of work—that of entomological science. Not alone because of my greater familiarity with it or because it has been the field of my own labor, but in part because I am constrained to think that the actual progress in this field has not been appreciated, even among biological students, as fully as the facts may warrant.

While to say that economic entomology has been developed in the last quarter century would be putting it too strong, it is true that so large a part of the growth, both for the determination of the fundamental principles and for the application of these to special problems has occurred within this period that it is not unfair to claim it for this epoch.

Less than fifty years ago I was rapping potato vines over a tin pan to catch the potato beetles that were devastating the potato fields in Iowa. In fact, as far as I recall, this was my first entry into the field of economic entomology and I believe about my first financial income was derived from this sort of service. But it was a good many years afterward that methods of control for that pest based on knowledge of habits, life history and chemical poisons were an accomplished fact in economic entomology.

The warfare with the Colorado grasshopper, the cotton worm, the San José scale, the gipsy moth, browntail moth, cotton boll weevil and such old-time pests as the codling moth, chinch bug and Hessian fly have either been fought and more or less completely won within the last quarter century or so nearly within it as to form a part of its history.

One of the very striking lines of progress has been in the transportation of the parasitic enemies of injurious insects, a phase of economic work which had only just begun twenty-five years ago, and which has been practically developed within the last decade with special reference to the depredations of the gipsy moth and the browntail moth. While this mode of contest with injurious insects, especially those which are introduced is not as yet entirely past the experimental stage, so much encouragement has been derived from recent results that we must certainly look upon it as a very important phase of entomological investigation, and one from which we will almost certainly secure important results for certain pests. It may not be possible to duplicate in any case the phenomenal success attained in the control of the cottony-cushion scale in California, but the success with that species and the less perfect success in the case of others must at least point the way to further efforts, and we may expect that a certain number of important species may finally be controlled in this manner.

The methods for control for introduced species the spread of which may be retarded by quarantine or inspection have been developed entirely within the quarter century and the service rendered in this manner is beyond computation.

To a large extent, the content and method of economic entomology have been appropriated in other special fields. Especially is this true in horticulture, where the methods and results of entomological re-

search are appropriated to such a degree that I doubt not many students fail to realize the incorporation. In medicine, also, while we still may speak of medical entomology, the relations to medical research have been so close that we may find difficulty in separating the doctor studying entomology from the entomologist investigating insects with reference to their medical aspects. The fact is that various fields have been opened up to a far greater extent than is possible for one man to follow and we have reached a stage of differentiation when to keep abreast of progress one must confine his effort to a limited part of the entomological field.

But a feature of the subject which I wish especially to emphasize is the attitude of science, or, to be more personal, the scientific worker toward the application of science in human affairs and for human welfare, that is, toward economic or applied science in all its phases.

The time was when probably the greatest efforts in invention and in the application of knowledge were devoted to engines of human destruction, and while this effort may have been a stimulus in the acquisition of knowledge, it could hardly be considered an influence for the promotion of the race.

Now, however, our boast is rather toward the progress in preservation and promotion of life. It is considered cause for glory that we can reduce the percentage of infant mortality, that we can check the spread of pestilence, that we can minimize the dangers of travel, cut down the property loss and the death list from fire or other disaster, and, in short, lengthen the span of human life and improve its opportunities for betterment and enjoyment. And, more significant perhaps, is the fact that such improvement is expected and in large degree made to apply to humanity as a unit, not to any individual or special class.

This attitude is the more conspicuous if we go back a few years to note the trend of scientific ideal. Read, for instance, the plea by Professor Rowland, the brilliant physicist, for devotion to pure science, given in 1885.

I remember how in my own experience scarce thirty years ago the venerable Dr. Hagen, doubtless the most profound student of entomology of the time if not of the century, made a most emphatic plea with me, with all the force of his German accent, not to go into economic entomology, but to give my effort to the pure science, "for the love of the science."

Now I believe that this attitude differed more in appearance than in fact, that the devotees of science, while some of them really did not care to have their discoveries made of any value to mankind, were really protesting against the commercializing of their scientific talent rather than the utilization of science for the good of humanity and often a plea simply for continuous drafts on original sources of knowledge instead of mere applications of knowledge gained. Certainly it is inconsistent with any reasonable desire for the acquisition of knowledge to deplore its use. Nor does it look strictly consistent for a person with this claim to sell his talent even to a university or a research institute for so much even as the moderate salaries that they usually afford.

But the attitude which I believe is becoming most dominant with scientists is that of the service of science to humanity at large, and the wish that beyond reasonable return for the work involved the profit should not be allowed to pile up for the benefit of a few.

What satisfaction is there in discovering a method by which to gain a double

crop from the soil, to avoid loss from destructive agencies, or to double the capacity of human labor if the gain is all absorbed by an aggressive few and the scientist and the real producer are left with no betterment of condition.

Such absorption does too often occur and it is not much to be wondered at that the pessimistically inclined should question what profit there is in our boasted scientific progress if the advantages of it all are to be seized upon and appropriated by an inner circle who can. One of the most important problems of the age is to discover how the gains of scientific discovery may be equitably shared by all deserving members of society.

But such an occasion impels us to look forward as well as backward. What will the next quarter century of science reveal to us of the unknown, what problems of age-long study will have yielded their solution, what theories of to-day will have vanished and what will be the nature of those to take their place. For this we can simply say wait and see; we may be content to believe that progress must continue and I believe we may also say that in most lines this progress will be on the foundations already laid. For one, I have sufficient faith in the science of to-day to believe that we have reached a secure footing and that we may push forward with confidence that the structure we build will not be doomed to complete destruction, even if in some of its details the lines must be recast. At least one strong ground for effort is confidence in the truth and permanence of the structure on which we work and despite occasional voicings of dissent I would hold for faith in our own work.

When the next quarter century shall have passed and you celebrate another anniversary, as I have no doubt you will, for the academy is now so fully established that its lapse is unthinkable, you will plan a wider home-coming to include the many members who will have scattered farther still to the ends of the earth and I shall hope to meet many or all of you now here with many yet to come in that semicentenary of our birth. Mr. President, you need not for that occasion send me any invitation. I shall come without one if alive, as I hope to be, and if it is within the range of human possibility to do so. But whether here in flesh or not, I assure you I shall be in thought and spirit, for I shall carry with me from this day on not only my early love and devotion for the academy, but an abiding appreciation for the honor you have shown me in asking me to be present with you and for the cordial greetings from you all. For all this and for your kind indulgence in listening to these remarks, I most sincerely thank you.

HERBERT OSBORN
OHIO STATE UNIVERSITY

ECONOMY IN UNIVERSITY ADMINISTRATION

I PROPOSE to consider briefly what I believe to be the most important factor in university economy, namely, the selection of the work which the university shall undertake.

Every important development depends upon two conditions: first, an adequate stock of energy; second, the selection of a few out of many possible channels through which that energy may produce its best results. A man will grow apples. His first concern is to secure a maximum amount of apple-producing energy in the form of well-bred stock, good soil, appropriate fertilizers, *et cetera*. His second concern is to save that energy from being wasted through weeds, through too many trees per acre, too many limbs upon the trees, or too many apples upon the limbs. His chief

labor is to destroy alien growths, cut down redundant trees, cut off redundant limbs, and cull out redundant apples, so that the total apple-producing energy at his command may through a few channels produce the largest possible crop of the best possible apples. Wherever any first-rate result is to be secured, there must be these two conditions—adequate wealth of resources, but also severe selection. "To know how to omit," says Stevenson, "that is the whole of art."

The universities of the United States, taken as a whole, have had decided success within the past quarter century in meeting the first of these two conditions of development. The resources of the universities still fall far below the demands which our society makes upon them for service; but the absolute increase in university funds from private and public sources within that time has been very great. It is the belief of the writer that the universities have not been equally successful in meeting the second condition of development, and that the paramount need in our university administration is a severe selection of the channels through which our resources shall be expended.

The pressure toward expansion, toward the multiplication of colleges, schools, departments, subdepartments and individual courses, is constant. All those who help determine what the university shall undertake, trustees, president, heads of departments and individual members of the faculty, feel this pressure. Part of the pressure is meretricious, proceeding from unworthy rivalry between universities, or from unworthy rivalry between departments, or from other motives comparable to those which appear in the lower forms of commercial competition. Part of the pressure toward expansion is fundamental, proceeding from the deep social needs which have given rise to the university itself. There had to be an enormous expansion of the university's activities in comparison with what they were in 1875. The university exists to solve the problems which our complicated civilization must solve, and to train up men able to take the varied and difficult kinds of work required by that civilization. The so-called university of 1875 fell far short of doing either of these necessary things. The universities, taken together, must do both these things, must represent the whole of civilization as it is, and must attack every problem around the whole sphere of possible discoveries.

In order to do this, it was necessary, for one thing, that the universities should supplement the liberal arts college as it was in 1875 by the addition of new departments, schools and colleges, and for another, that each of the fundamental departments should undergo a corresponding expansion. A university department of chemistry, for example, does not exist in order to teach a little primary chemistry to sophomores. It exists to make the great underlying science of chemistry render the fullest possible service to mankind. A university department of chemistry, if properly supported and manned, tends to become a college in itself, with a budget and faculty comparable to that of the entire institution of forty years ago; and, in the best cases, everything done in the department is worth more to society than it costs. In many cases, the people have realized this quickly, and have met daring expansions made by the universities with means adequate for their support. In some cases, we have a university whose circle of activities approaches correspondence with the whole circle of services which society requires from learned men.

Unhappily, however, there is no univer-

sity rich enough to carry out with success so vast a program. In truth, all the universities in the world are not now rich enough to do so. The richest university is, therefore, in peril of so multiplying the lines of its work that all the lines of its work shall be lowered in quality. It is very possible in this way for a university with a million or more of income to so scatter its resources that it can do nothing at all of first-rate quality. Whether a university be relatively rich or poor, its greatest mistake, financial and educational, is to indulge in a policy of expansions which fail to elicit their own support and which must, therefore, live by sapping the strength from established lines of work. This mistake may be made by the regents and the president in establishing new departments, schools or colleges, or by heads of departments in establishing new subdepartments or new sporadic courses, or by individual members of the faculty in undertaking indiscriminately wide lines of research. All these different forms of expansion come to the same thing if they involve spending money upon more things than can be done well.

The penalties which fall upon an institution which sins greatly in this respect are severe. The library suffers. The laboratories suffer. Salaries are kept down. The best men escape. Those who remain lose heart. The quality of everything done about the institution is lowered. The final calamity is that all this tends to bring to and establish in the institution a faculty of mediocre men. There is no known remedy for this calamity. If the institution grows suddenly rich, the way to progress is blocked by a group of men who can not be removed except by death, and whose mediocrity will pervade the institution for a generation. It is my belief that there is no American university which has not suffered more or less by expansions which have affected the quality of its work. It is certain that some of the universities with small incomes, in their effort to cover every field, have brought themselves in every field to a deplorable weakness. And it is certain that some among the universities with large incomes have, through the same error, grown large without having grown great.

By way of remedy, I venture to make four suggestions, two of which I have discussed at greater length in a former paper.

1. Heads of departments should, I believe, resist the constant temptation to multiply courses of elementary collegiate grade in order, as the phrase is, to cover the ground represented by the department. Instead of this policy, which tends toward waste and lowered efficiency, there should be severe selection of a narrow program of freshman-sophomore courses which shall represent typically the best things in that field. I believe that this second policy, carried out with intelligence by men who believe in it, means, for one thing, a radical economy in university resources, and, for another, greatly improved work. Even if there were no question of finance involved, the greatest pedagogical need in our colleges, as in all our schools, is the selection of a few essentials, so that students may master something intensively, and acquire the habit of mastery.

2. Heads of departments should resist the constant temptation to allow the multiplication of redundant junior-senior electives. Whenever a new elective of this grade is proposed, it should be confronted with two questions: (1) Is this course an essential part of the department's undergraduate program? (2) Is the course an essential part of a program of research which the department is prepared to undertake? If it serves neither of these two interests, it is the enemy of both. It should

be seen by all concerned that the sporadic elective is the greatest obstacle in the way of raising the salary of the man who gives it, as well as that of all his colleagues. For the per capita cost of such a course is nearly always very high, and can come from nowhere except the total available salary fund. The university must maintain many small classes in its advanced work. A class of one may fully justify itself to the university world and to the state which pays for it. But it is the interest, as well as the duty, of all concerned to see that every small class shall so justify itself.

3. Members of the graduate faculty should resist the temptation to provide equipment for research over wide ranges of their subjects. Instead of this, the professor who conducts research should plan a program of studies within which he and his students for a period of years shall work, and upon which his appropriations for graduate work shall be concentrated. No hard and fast line of definition can be drawn between these two policies. The broad difference between them is clear. Only the richest of our universities can do anything of quality in the way of research if the first policy is followed, and even in those cases there must be a great and unnecessary waste. On the other hand, any one of a score or more of our universities can successfully carry out the second policy. Let me give two out of many possible illustrative cases. Ten years ago a young scholar found himself in a university whose library was wholly inadequate for his studies. In presence of this situation he selected with deliberate care a program which he thought the university would be able to support. The trustees met his plan with warm approval. The total amount appropriated in the ten years was not great, but it proved sufficient for the purpose, for it enabled the man to write the best book within his special field, and incidentally it enabled him to accumulate the best working library for that field in the country, with two exceptions. The other case presents still more striking proof of the effectiveness of this policy, chiefly because it has been carried on for a longer time. In this case the man began twenty years ago. Within that time he and his advanced students have worked along the lines of two programs. He has had many graduate students, including a considerable number who have taken the doctor's degree under his direction. In both the special fields referred to he is recognized as the first authority in the world. He has accumulated for his work, so he states to me, the best library in the world. Yet the entire cost of this special library and of his laboratory equipment would be well within the means of any standard university in the country. If the same man had been led astray in the outset into browsing about over his interesting field, the whole of his splendid achievements would have been impossible.

Before I leave the subject of research, I wish to say that it is a great waste of resources to force the entire faculty into this form of work. Let each man do what he cares most for and can do best. If a man can write good prose or good poetry, or can train any of his students to do so, let us preserve that man and his work as precious, and not spoil all with the demand for orthodox doctors' theses. If a man finds out how to train freshmen in English composition, or how to develop a finer practise of honor among college men, let us count these achievements worth as much as if he had written a thesis upon what some one did with the same problems in England a hundred years ago.

4. The regents or trustees should be on guard against the constant temptation to multiply departments, schools and colleges

which are not justified. It is obvious, as I have already said, that the regents cannot follow any set rule of thumb in this their most important sphere of decisions. They may upon occasion err disastrously in either direction. What we hope from the regents is that they shall at all times stand resolutely for the maintenance of *quality*, and that they shall refuse to permit any student-catching or appropriation-catching expansion which can not justify itself in terms of fundamental social service. If the regents go astray at this point, whether through bad counsel or from their own initiative, nothing can save the university under their control from grave deterioration.

This paper should not conclude without reference to that university which in its early history went to the extreme in the concentration of its resources. I refer, of course, to Clark University. The trustees of that institution believed that they were not justified in founding one more New England college. They had not enough money to found a university where the usual round of departments should be adequately represented. Under the advice of G. Stanley Hall, they resolved upon the unprecedented plan of beginning a university with five departments. The result of this course was that in each one of those departments they secured a group of scholars unsurpassed in the country, if anywhere in the world. They had Whitman, Loeb, Michelson, Nef, Boas, Mall, Story, Bolza, Donaldson, and many other men who then had, or since have, won international standing. They had the only American scholar who has won the Nobel prize. The group of scholars at Clark and the work done there were at once recognized by the university world as of first-rate importance. A change of mind on the part of the founder and other conditions have modified the later history of Clark. Its example is one which no other university, certainly no state university, can follow in the extreme. But the history of Clark proves one thing of the utmost importance—that a university of relatively limited means may go into the front rank by sagacious concentration of its resources.

The members of this association realize well the difficulty of securing money for the university. But, in truth, it is not so difficult to get money as it is to spend it so as to have a minimum of waste and a maximum of efficiency. Our task is to discover and create the university for our century. The discovery demands statesmanlike discrimination between what is essential and what should be pruned away. The creation demands something still more difficult, for it demands a thousand decisions which cut across private interests. The institution which we actually create will depend upon the self-denial, the integrity and the courage with which members of the university day by day make these decisions.

WILLIAM LOWE BRYAN
INDIANA UNIVERSITY

LECTURES ON THE SMOKE PROBLEM

IN the fall of 1911 the Department of Industrial Research of the University of Pittsburgh was provided by a Pittsburgh business man with funds for a thorough investigation of the smoke nuisance. At the present time the investigation is being conducted by a staff of twenty-five specialists, of whom seven are giving their entire attention to this task. Some of these men are studying the effect of smoke and soot on the atmosphere, on the weather, on plant life, on buildings, on the public health; some are investigating the economic damage done by smoke and soot; others are making a detailed study of the mechanical devices for preventing or abating smoke; and still others are inquiring into the chemistry and physics of smoke and soot, into the laws

concerning the smoke nuisance, and into the history of the subject as a whole.

Recognizing the interest in the smoke problem manifested by a large number of American cities, and in response to inquiries that have been made, the department announces that the members of its staff are prepared to lecture on the following phases of this problem:

1. The Smoke Nuisance (a general presentation of the main phases of the subject).
2. Smoke and the Public Health.
3. Smoke and the Cost of Living.
4. Smoke and Plant Life.
5. Methods and Means of Smoke Abatement.
6. The Effect of Smoke on Buildings and Building Materials.
7. The Psychology of Smoke.
8. The Smoke Nuisance and the Housekeeper.

R. C. Benner
Department of Industrial Research,
University of Pittsburgh

A Science Library for Children

In association with the educational work which the Chicago Academy of Sciences has been conducting during the past few years a strong demand has arisen or a Children's Library and Reading Room. In response to this demand the trustees of the academy have furnished one of the rooms in the museum as a Children's Library and about seven hundred books have now been selected as a nucleus. Appropriate periodicals and a picture collection, in part for exhibition on the bulletin board and in part for study at the tables, will also be included. Stereoscopic views have been selected for their importance in geographic studies of foreign lands and for illustrating the agricultural and industrial activities of various parts of the world.

It is proposed to make this a carefully selected library of books suitable for children to read. A few of the books are of a somewhat technical nature, although most of them are in non-technical language. A few biographies of the great scientists, several historical sketches of the progress in pure and applied science, stories based, in part at least, on natural history studies and accounts of explorations which are instructive along scientific lines have been selected. Miss Mary A. Hardman, a member of the academy staff who has been offering courses of instruction to children at the academy during the last two years, has been appointed librarian. This Children's Library will be open to the public on and after August 5, 1912.

Scientific Notes and News

Among the degrees conferred by the University of Michigan at its recent celebration was the doctorate of laws on Dr. William H. Howell, professor of physiology at the Johns Hopkins University, and the doctorate of science on Dr. John J. Abel, professor of pharmacology.

At the annual commencement of Lehigh University, the honorary degree of doctor of laws was conferred upon Charles Leander Doolittle, professor of astronomy and director of the Flower Astronomical Observatory of the University of Pennsylvania.

Dr. Harvey W. Wiley received the degree of doctor of science from Lafayette College.

Dr. Henry Prentiss Armsby, director of the Institute of Animal Nutrition of the Pennsylvania State College, has been elected a foreign member of the Royal Academy of Agriculture of Sweden.

A banquet in honor of Dr. J. A. Witherspoon, president elect of the American Medical Association, was given under the auspices of the Nashville Academy of Medicine and the Nashville Board of Trade, on July 3.

Three portraits were presented to the University of Pennsylvania at its recent commencement: one of Provost Edgar F. Smith, the gift of the class of 1902 college, painted by H. H. Breckenridge; one of the late Professor Henry W. Spangler, the gift of alumni and students of the mechanical and electrical engineering departments, painted by M. H. Kevorkian; one of the late Professor Joseph Leidy, the gift of his friends, painted by A. P. S. Haeseler.

Dr. W. M. Davis has retired from the Sturgis Hooper professorship of geology at

Harvard University. He will continue to reside at Cambridge. Professor R. A. Daly, of the Massachusetts Institute of Technology, has been appointed to the chair vacant by the retirement of Professor Davis.

PROFESSOR MORTON PRINCE has retired from the active duties of the chair of neurology in Tufts College Medical School, and becomes professor emeritus. He is succeeded by Professor J. J. Thomas, now assistant professor of neurology.

AFTER thirty years of distinguished service in the University of California, Edward J. Wickson, professor of agriculture and director of the Agricultural Experiment Station, has been granted a year's leave of absence, which he will spend in Europe. At its expiration he will be entitled to claim a retiring allowance under the terms of the Carnegie Foundation.

OSWALD SCHREINER, Ph.D., and Elbert C. Lathrop, A.B., have been awarded the Edward Longstreth medal of merit of the Franklin Institute, Philadelphia, for their paper on "The Distribution of Organic Constituents in Soils" appearing in the August, 1911, issue of the *Journal* of the Franklin Institute, "a comprehensive account of important recent researches in agricultural chemistry."

THE Livingstone gold medal of the Royal Scottish Geographical Society has been awarded to Captain Roald Amundsen for his geographical discoveries on his recent expedition to the south pole.

MR. JAMES MURRAY has been awarded the Neill prize by the Royal Society of Edinburgh for his papers on the Rotifera and Tardigrada.

DR. H. H. RUSBY, dean of the College of Pharmacy of Columbia University, New York, has resigned to establish a pharmacognostical laboratory in the city.

PROFESSOR FRANCIS CARTER WOOD has been appointed director of cancer research under the George Crocker Research Fund of Columbia University.

MR. JEROME D. GREENE, general manager of the Rockefeller Institute for Medical Research, has resigned that position to enter the office of Mr. John D. Rockefeller, where he will be a member of the staff in charge of Mr. Rockefeller's business and philanthropic interests. Mr. Greene will continue as a trustee his connection with the Rockefeller Institute for Medical Research. Mr. Henry James, Jr., of Cambridge, Mass., has been appointed to succeed Mr. Greene in the management of the Rockefeller Institute. He is a graduate of Harvard College, in the class of 1899, and of the Harvard Law School in 1904, since when he has been engaged in the practise of law in Boston. He is a son of the late Professor William James.

MRS. MARY SCHENCK WOOLMAN, professor of domestic arts in Teachers College, Columbia University, has been elected president of the Women's Educational and Industrial Union.

MR. EDGAR A. DOLL has been appointed associate psychologist in the department of research of the Vineland Training School, Vineland, N. J.

PRESIDENT HOWE, of the Case School of Applied Science, has been given a year's leave of absence for the purpose of rest and recuperation. Dr. F. M. Comstock, professor of drawing and descriptive geometry and senior member of the faculty, will be the acting president during the next college year.

PRESIDENT R. C. MACLAURIN, of the Massachusetts Institute of Technology, has gone to Europe, intending to visit the technological schools of Great Britain and the continent with reference to the plans for the new buildings of the Massachusetts Institute.

DR. L. O. HOWARD has been appointed as a delegate from the Entomological Society of Washington to the second International Congress of Entomology to be held in Oxford this coming August.

PROFESSOR O. D. KELLOGG, of the University of Missouri, is on leave of absence in Göttingen. He will attend the meeting of the International Congress of Mathematicians at Cambridge, England, and of the British Association for the Advancement of Science at Dundee, Scotland.

Professor Frederick H. Safford, of the University of Pennsylvania, has sailed for Europe and will attend the International Congress of Mathematicians at Cambridge.

Professor George C. Whipple, Mr. M. C. Whipple and Dr. J. W. M. Bunker, of Harvard University, are making a sanitary survey of Lake Ontario near the mouth of the Genesee River, in order to ascertain the effect of the sewage of the city of Rochester, N. Y., on the river and lake.

Frederick Haynes Newell, director of the United States Reclamation Service, delivered the commencement address at the Case School of Applied Science on May 29, his subject being "The Engineer in Public Service." At the close of the address the honorary degree of doctor of engineering was conferred upon him.

Dr. Joseph Jastrow, professor of psychology in the University of Wisconsin, has given three lectures on "The Sensibilities," "The Emotions" and "The Appraisal of Human Qualities" at the summer session of the University of California.

Dr. E. F. Bashford, director of the Imperial Cancer Research Fund of London, has accepted an invitation to deliver the Middleton-Goldsmith lectures of the New York Pathological Society next October.

Mr. R. W. C. Shelford, known for his work in entomology, formerly connected with the Oxford Museum, died on June 22, aged thirty-nine years.

Dr. Ferdinand Zirkel, emeritus professor of mineralogy at Leipzig and eminent for his contributions to this science, died on June 12, aged seventy-four years.

Dr. Ernst Schulze, professor of agricultural chemistry at the Zurich Technological Institute, has died at the age of seventy-two years.

Professor Charles André, director of the Lyons Observatory, well known for his astronomical publications, died on June 6, aged seventy years.

Under the will of the late Lord Wandsworth, a sum of £10,000 was bequeathed to Sir William Bennett, to be applied by him at his discretion for the promotion of medical research. Sir William has now decided to entrust the administration of the legacy to the London School of Tropical Medicine, under conditions which include the establishment of a research scholarship.

The organization of the Canadian National Museum has recently taken a new impetus, due to the completion of its home, the Victoria Memorial Museum building at Ottawa. Lawrence M. Lambe, representing paleontology; Harlan I. Smith, representing anthropology; Percy A. Tavernier, representing zoology; Robert A. A. Johnston, representing mineralogy, and Reginald W. Brock, director, have been elected as the executive committee of the museum staff, Mr. Johnston serving as secretary. Several expeditions are in the field. Research work is also being carried on in the museum and popular educational work is not being neglected.

The agricultural demonstration train, which the University of California sends out yearly, through the cooperation of the Southern Pacific Company, in the year just completed was visited by more than 102,000 persons, a gain of 24,000 over the previous year. It has proved useful in bringing to the attention of farmers improved agricultural methods and sources of information and aid in farming problems.

The United States Weather Bureau has changed the cooperative station at the North Dakota State University to a special meteorological station. As such, it is known as the Grand Forks station. It is closely affiliated in its work with the university's department of geology with Assistant Professor Howard E. Simpson in charge as special meteorological observer, the work being carried on as a part of the geographical work of that department. A complete meteorological equipment is furnished by the United States Weather Bureau. Constant records are kept of temperature, pressure, wind velocity and direction, sunshine and rainfall. Regular observations are made

twice daily, at seven o'clock, morning and evening. The morning observations are telegraphed to St. Paul, where they enter a circuit reaching all important cities between Winnipeg, New York and Washington. The evening observations are reported monthly and are used in the compilation of climatological data.

THE production of anthracite in Pennsylvania in 1911, according to a statement just issued by Statistician E. W. Parker, of the United States Geological Survey, broke all previous records, exceeding the previous maximum output in 1907 by 4,700,000 long tons. The complete returns to the Survey show a production in 1911 of 80,732,015 long tons, valued at $174,852,843. This was an increase over the 1910 output of 5,298,767 long tons in quantity and $14,577,541 in value. In this increased activity and augmented production in 1911 the anthracite industry was in marked contrast to the bituminous industry, which showed decreases throughout most of the mining regions. Moreover, in most of the bituminous districts prices were generally lower, whereas the average price of anthracite in 1911 was 5 cents a ton higher than in 1910. Prices for the domestic sizes remained the same, but greater returns were received from pea coal and the smaller sizes. The greater production of anthracite in 1911 was probably due to increased activity in anticipation of a possible coal strike in April. However, the extremely severe weather of the winter practically exhausted any accumulated coal before the termination of the three-year period of wage agreements on March 31, 1912. It is an interesting fact, showing the highly organized condition of the anthracite industry—the so-called coal trust—that whereas in former years there was enormous mine waste in this industry, nowadays practically everything mined is utilized. Formerly enormous quantities of small coal and coal dust were thrown on to the waste heap, but now such "waste" is sold as it is mined, and the culm piles are being reworked. In 1911 the recovery from the culm piles and the smaller sizes obtained from the freshly mined coal constituted over 40 per cent. of the total quantity of anthracite marketed.

IN the early part of the year 1911, while engaged in the Smithsonian Biological Survey of the Canal Zone, and the adjacent parts of Panama, Mr. E. A. Goldman made a collection of 368 mammals. This collection, representing between 40 and 50 genera, includes 12 new species and sub-species, of which descriptions have just been published by Mr. Goldman (Smithsonian Miscellaneous Collections, No. 2073) in advance of the general report on mammals of this region. Nine of the new forms are from the Canal Zone, and the others were collected by the author when he was on a trip to the mountains near the headwaters of the Chagres River, Panama, in March, 1911. The new animals include: two opossums from near Gatun; two squirrels, of which one is known as a pigmy squirrel; four rice-rats; a yoke-tooth rat, which was found to be one of the most abundant rats in the grassy clearings of the Canal Zone; three spiny rats, including one known as an octodont, and named after Colonel George W. Goethals, U.S.A., chairman and chief engineer of the Isthmian Canal Commission. Among the birds collected by Mr. Goldman, while engaged on this survey, there are two new species of nun birds. These are described by Mr. E. W. Nelson, of the Department of Agriculture, Biological Survey, in a pamphlet published by the Smithsonian Institution, which forms the seventh paper on the results of this survey.

THE statistics of births and deaths in the German empire during 1911 show for Prussia an excess of births over deaths of 490,333, as compared with 581,465 in 1910. In Bavaria, where the returns have just been issued, the excess of births over deaths was 73,656, as compared with 84,682 in 1910. Thus the falling off in the growth of the population in Prussia and Bavaria together was more than 100,000. The Prussian ministry of the interior has issued a rescript to the provincial governors requiring them to obtain informa-

tion from doctors, clergy, teachers, lawyers and others regarding the cause of the fall in the birth rate. The main questions are whether the limitation of families is intentional and, if so, what are the principal social and economic causes, and whether the birth rate is falling among the working as well as among the middle classes.

The production of salt in the United States in 1911 was 31,183,968 barrels of 280 pounds each, valued at $8,345,692, according to W. C. Phalen, of the United States Geological Survey, in a report on salt and bromine, just issued as an advance chapter from "Mineral Resources for 1911." This is an increase compared with 1910 of 878,312 barrels in quantity and $445,348 in value. In addition to the domestic production 1,014,926 barrels of salt was imported. This importation was partly balanced by the exports, 349,092 barrels, leaving an excess of imports over exports of 665,834 barrels. The United States is amply able, according to Mr. Phalen, to supply all the domestic demands, as the capacity of the active mines and plants is largely in excess of the present output. Moreover, there are many plants now idle that could easily resume operations should conditions warrant.

UNIVERSITY AND EDUCATIONAL NEWS

The Massachusetts Institute of Technology has received from Mr. Theodore N. Vail, president of the American Telephone and Telegraph Company, a gift of the valuable library on electricity and engineering of the late George Edward Dering, of England. The library is valued at about $100,000, and Mr. Vail has made an additional gift for its maintenance.

The estate of the late Dr. Francis Bacon is larger than had been anticipated, and the value of his bequest to Yale University will, it is said, reach $500,000, of which about $300,000 goes to the library, and $200,000 to the college and the Sheffield Scientific School for the assistance of students.

By the death of the widow of the late R. N. Carson, of Philadelphia, the sum of six million dollars bequeathed by him to establish the Carson College for Orphan Girls, is released for this purpose.

There are in course of construction at the University of Missouri a building for the department of physics at a cost of $100,000 and another for the department of chemistry, mainly for agricultural chemistry, at a cost of $60,000. The latter building has been named Schweitzer Hall in memory of Professor Paul Schweitzer who was for nearly forty years connected with the department.

The Educational Fund Commission, to whom has been intrusted the interest of a quarter of a million dollars for the purpose of sending selected teachers of the public schools of Pittsburgh for summer studies, has this year arranged to send

33 teachers to Columbia University,
30 teachers to Carnegie Institute of Technology,
19 teachers to Chautauqua Summer School,
14 teachers to Harvard University,
6 teachers to Cornell University,
5 teachers to University of Pittsburgh,
4 teachers to University of Pennsylvania,
4 teachers to University of Colorado,
3 teachers to Vineland Training School, Vineland, N. J.,
2 teachers to School for Atypical Children, Plainfield, N. J.
2 teachers to Pennsylvania State College,
1 teacher to Dartmouth,
1 teacher to University of Chicago.

Three hundred and twenty-nine teachers have now enjoyed the benefit of this fund, given by an anonymous donor, and it has been productive of such excellent results toward greater efficiency in our schools that the commission has already arranged to send quite a large contingent in the summer of 1913. An efficient and helpful vocational bureau has also been organized by the commission.

The Rev. Stephen Morrell Newman has been elected president of Howard University to succeed Dr. William P. Thirkield, who has become the Methodist Episcopal bishop of the diocese of New Orleans.

Dr. William Leslie Hooper, professor of electrical engineering, has been appointed acting president of Tufts College.

DR. JOHN ZELENY, professor of physics, has been appointed acting dean of the Graduate School for the coming year, at the University of Minnesota.

THE board of trustees of Colgate University has created a new office, that of vice-president of the university, and has elected Dr. Melbourne Stuart Read to the office. Dr. Read is professor of psychology and has been secretary of the university for several years.

MR. F. R. MARSHALL, now of the Ohio State University, has accepted the chair of agricultural industries in the University of California. Among appointments to agricultural instructorships are those of James Koeber, from Oregon Agricultural College, in farm mechanics, and William H. Arnold, in chemistry and botany, both men at the university farm; W. F. Gericke, from Iowa State College of Agriculture, and Paul S. Burgess, from Illinois, in soils, and Ralph H. Taylor, a University of California graduate, in horticulture. Giovanni Barovetto and A. C. Way are appointed to aid in the university's investigations for improving methods in grape growing, wine-making and the raisin industry; J. D. Denny to aid in improving the varieties of wheat, barley and other cereals grown in California; R. C. d'Erlach to help with the inspection of commercial fertilizers, and Meredith R. Miller, to aid in similar inspection of insecticides. Walter W. Bonns has been appointed plant physiologist at the Riverside Citrus Experiment Station. Two promotions are of William B. Herms to be assistant professor of applied parasitology, and W. G. Hummel to be assistant professor of agricultural education.

THE New York State College of Forestry at Syracuse University announces the personnel of its staff in the work of instruction, investigation and demonstration as follows: Dean Hugh P. Baker, M.F. (Yale, '04), D.Œc. (Munich, '10), is director of the college and professor of silviculture. Dean Baker assumed his duties on April 1, coming from the directorship of the department of forestry at Pennsylvania State College. Frank F. Moon, B.A. (Amherst, '01), M.F. (Yale, '09), resigns an associate professorship of forestry at Massachusetts Agricultural College to become professor of forest engineering at Syracuse. Earlier, Professor Moon was forester of Highlands of Hudson Forest Reservation for the New York State Forest, Fish and Game Commission. Philip T. Collidge, graduate of Harvard College and of Harvard Forest School, becomes professor of forestry and director of the ranger school, which will be a part of the College of Forestry operating on recently acquired lands at Wanakena on Cranberry Lake. Professor Collidge resigns the directorship of the Colorado College of Forestry at Colorado Springs and of the Ranger School at Woodland Park, Colo., to take up this work. Nelson C. Brown, B.A. (Yale, '06), M.F. ('08), comes after an extended experience in the forest service and as assistant professor of forestry in Iowa State College to be assistant professor of forest utilization. John W. Stephen, B.A. (Michigan) and M.F. ('07), becomes assistant professor of silviculture, resigning for this purpose his relation as state forester with the New York State Conservation Commission. Edwin F. McCarthy, B.Sc. and M.F. (Michigan, '11), has served during the past year and continues as assistant professor of forestry, having especially the work in forest technology.

AT the University of Illinois, Dr. Lotus D. Kaufman, at present supervisor of the training school of the Eastern Illinois Normal School at Charleston, has been appointed professor of education, and Dr. W. E. Burge, now of the Johns Hopkins University, assistant professor of physiology.

DR. ARTHUR I. KENDALL, of the department of preventive medicine and hygiene, Harvard Medical School, has been appointed professor of bacteriology at Northwestern University. Dr. Harold L. Amoss, of the same department, has been appointed assistant in bacteriology and pathology at the Rockefeller Institute.

DR. DAVID VANCE GUTHRIE has been promoted to be professor of physics and astronomy at the Louisiana State University.

Dr. Ernest Anderson, research instructor in chemistry at the University of Chicago since 1909, has been appointed assistant professor of general and physical chemistry at the Massachusetts Agricultural College, Amherst, Mass.

James A. Gibson, instructor in analytical chemistry at the University of Missouri, has been promoted to be assistant professor.

Dr. Geo. I. Adams has been appointed professor of geology in the Pei Yang University at Tientsin, China, and sailed from San Francisco on July 12.

Dr. E. E. Glynn has been appointed to the George Holt professorship of pathology at Liverpool, vacant by the death of Sir Rubert Boyce. Dr. Glynn has for some years held the post of lecturer in clinical pathology in the university.

DISCUSSION AND CORRESPONDENCE

THE MISUSE OF THE TERM "MELANIN"

Inasmuch as there has recently been a plea for a more exact nomenclature in genetics, it may not be amiss to ask for a more exact terminology in some divisions of bio-chemistry. It is but natural that we should think of a substance in the terms of its most prominent trait, and that whenever we see that trait we should associate it with the substance. It has thus come to pass that all substances which are dark in color and presumably "indestructible" have been termed "melanins." This terminology has nothing to commend it and it often leads to great confusion. To one who has been endeavoring to arrange the literature of the animal pigments the misuse of the term "melanin" has caused an immense amount of unnecessary reading.

All bio-chemical text-books define melanin in more or less the same language "amorphous black or brown pigments . . . which occur in the skin, hair, epithelium cells of the retina, in certain pathological formations, and in blood and urine in disease."[1]

[1] Hammarstein-Mandel, "Text-book of Physiological Chemistry," Wiley & Sons, 1911, p. 792.

Among those who do not use the term "melanin" in its true meaning are a large number of chemists. In nearly every chemical journal we may find in the tables of the decomposition products of protein hydrolysis, a certain amount of "melanin" or "melanin nitrogen." It has long been known that when proteins are heated with mineral acids a black residue is produced which is insoluble in mineral acids, and *because it is black* it has been called "melanin." It may, or it may not, be related to the true melanin; there is at present absolutely no proof on either side; *but until it is shown to be related to the melanins in more ways than color or solubility, it should not be confused with the true animal pigments.* Whenever it is shown that the structure of the molecule of these products is essentially the same as that of the melanins then, and not until then, should they be classed with the melanins. In order to prevent the confusion which arises from this terminology I propose that we substitute for the "melanin" and "melanin nitrogen" of protein hydrolysis the terms proposed by Osborne, "*humin*" or "*humin nitrogen.*"

There are some chemists and many biologists who contend that the production of this black humin by the acid hydrolysis of proteins, indicates that the true melanins have an origin in the proteins. There is no evidence excepting the fact that humins are black and look like melanins. Cane sugar, when boiled with hydrochloric acid produces black humins, which are indistinguishable, except for the absence of nitrogen, from the humins of protein decomposition. Indeed, many of the protein humins may originate in the carbohydrate groups which some proteins carry. In all probability the formation of humins from proteins is the same sort of a reaction as the formation of the black products from sugar (*i. e.*, dehydration), and in the latter case there can be no doubt that the product is not a melanin.

Piettre[2] and myself[3] have isolated pigments

[2] *C. R. Acad. Sci.*, 153, p. 782.

[3] *J. Biol. Chem.*, 8, p. 341; *Biochem. Bull.*, 1, p. 207; *Bull. Soc. Chim.* (4), 11, p. 498.

which contain a protein residue, and Dyson,[4] has secured histological evidence which supports the belief that the mother-substance of the melanins is a protein. From my "melanoprotein" (*i. e.*, melanin containing the protein residue) I split off the pigment portion by a short boiling with acid, and obtained a nearly clear solution of amino acids and polypeptides. *By a longer boiling of these amino acids and polypeptides with hydrochloric acid, I obtained a considerable amount of humin.* In this instance both a melanin and humin were obtained from the same protein and are, therefore, very probably not identical. If humin is substituted for melanin in referring to the products of protein hydrolysis, there will be less danger of confusing those who are not chemists, and who are accustomed to scientific terms which have a definite meaning.

A second instance of *possible* misuse[5] of the term occurs in a recent article in SCIENCE (N. S., 35, p. 765). In speaking of the coat-colors of cow-peas Dr. Spillman states that "breeding experiments lead me to think that buff, brown and black were pigments related to melanin." Just how they were related chemically is not stated, but presumably it is by color and solubility, but as seen in the case of humin these are no criterion. Inasmuch as melanins are everywhere defined as *animal pigments,* or *pigments of animal origin,* it is as impossible for a melanin to appear in the vegetable kingdom as for the coat color of a rabbit to be due to anthrocyan. It would be far better to coin a new term for these plant pigments, and reserve melanin for *those dark pigments, which occur normally or pathologically, in the animal body, skin, hair or feathers.*

ROSS AIKEN GORTNER
COLD SPRING HARBOR, N. Y.,
June 19, 1912

[4] *J. Path. and Bact.,* 15, p. 298.

[5] Dr. Spillman does not say these pigments are melanins, but that they are "related to the melanins." Dr. Mann, in a later note (SCIENCE, N. S., XXXV., p. 1004), does state that a yellow or brassy-brown pigment and an intense black pigment are melanins.

"PRONOUNCED GĒN"

TO THE EDITOR OF SCIENCE: One of your correspondents, Dr. G. H. Shull, discussing in SCIENCE for May 24, 1912, the spelling and pronunciation of the word *gene,* used by writers on genetics, says that it is "pronounced gēn."

This is a good example of the dilemma in which men of science are placed. They must use language, they must translate and transliterate language, they must concern themselves endlessly with nomenclature, they must strive to change nomenclature or strive to prevent any change. And they must at times mention pronunciations, if only to object to them. Sometimes they seriously wish to convey a pronunciation on paper to their intelligent readers. And here is a case. Dr. Shull, a trained man of science, writes to the intelligent readers of SCIENCE, and says that a certain artificial word is "pronounced gēn."

And what does that mean? It means one of two, three or four or more possible pronunciations. The reader has to *guess* what pronunciation is intended. In other words, a man of science, writing in a journal of science, about an elementary matter, completely fails to accomplish his purpose.

Why? Because some orthodox men of science object to any accurate indication in print of the sounds of the human voice; because they object to any representation of sounds that is not contained in certain traditional spelling-books and dictionaries (that is, in certain stereotype plates owned by certain dealers in printed ware); because they will not give a hearing to the men of science who understand the subject; because they close their minds and their journals to science itself, when it mentions language. The Jaspers of science will not listen to the astronomers. "The sun do move," and we won't hear another word! And so our real men of science, when they wish to state facts of language, must express their meaning imperfectly or ambiguously, or else keep silence. But silence also is ambiguous.

How long is this condition to continue? How long will the controlling men of science

oppose the introduction into science of a correct and intelligible way of indicating the sounds of the human voice? How long will the American men of science who control scientific societies and scientific institutions and scientific journals, ignore or suppress the proposals of philological scholars to provide a definite system of indicating the sounds of the English language? How long will they oppose the movement to bring about a regulation of English spelling, so that English words may be spelt correctly and intelligibly, and so that a given man of science, in a journal devoted to science, and bearing the name of Science may present a simple idea, in simple letters, in a sure and certain way? How long? Ask our respected friends President X and Professor Y and Dr. Z, Editor P and Director Q, who sit at the gates of science, and scrutinize the tickets, and exclude every man who does not spell according to their Mohammedan way. In the name of the Prophet, phigs!

In the meantime the leaders in science will be writing in Science statements about language that are in fact futile, because, as we lawyers say, they are "void for uncertainty."

Of course I know, and you know, Mr. Editor, what Dr. Shull means when he says "pronounced gēn"; but we know it by a process of inference, and by a course of special study. No one else can tell what he means, except through the same process. The man of science wishes to be clear, but his colleagues won't let him. In the name of the Prophet, phigs! Charles P. G. Scott

Yonkers, N. Y.,
June 24, 1912

Formation of Spurred Flowers in Hybrid Calceolarias

Webber[1] refers to hybridization as the apparent causal agent in the development of a marked spur or horn on the lip of a hybrid *Calceolaria*. Characters apparently new are said to appear rather commonly in hybrids and the idea is advanced that the teratological structure just mentioned may be a new unit character of the genus *Calceolaria*. The statement is made that "no such character, so far as can be learned, is known in the Calceolarias, and it would seem to have been caused by the hybridization."

M. T. Masters[2] states that the formation of spurs or spur-like tubes is very frequent in some seasons in the corolla of certain Calceolarias (*C. floribunda*). An excellent figure (Fig. 169) is also given.

Orland E. White

Bussey Institution,
Harvard University,
June 18, 1912

[1] Science, N. S., 35, p. 606, April 19, 1912.

[2] "Vegetable Teratology," 1869, p. 316.

Scientific Books

High School Education. Edited by Charles Hughes Johnston, Ph.D. Charles Scribner's Sons. 1912.

To designate this book a notable effort in pioneer-work is to indicate at once its merits and its inevitable limitations. In its arrangement, in the assignment of general and of specific topics to writers whose interests concentrate in their respective fields of inquiry, it proclaims the fundamental belief that no single writer can hope to do justice to all the issues involved in secondary education. Where questions of general policy, of programs of study, of curricula and of method in individual subjects must be weighed to promote the ideals of efficiency, it is desirable that the inquiring teacher shall have the guidance of a number of experts whose utterances will help him to plot his own line of procedure. It speaks well for the firmness of the editor that his collaborators represent almost without exception a uniform tendency, though they are permitted full leeway in the advocacy of their individuality. Professor Johnston has on the whole been fortunate in the choice of his cooperating writers; even for some of the subjects that have not yet found general recognition in our high schools he has secured contributors of distinctly originative ability. Even though this book may be superseded before long by similar studies of greater value, it may claim the merit of having led the way to a proper consideration of the manifold problems of the secondary school.

The discussion of the educational significance of the various subjects in the curriculum of a secondary school, and of the methods that will make their teaching most effective, is preceded by five chapters in which a basis for the whole question of secondary education is offered. Of these chapters easily the most notable is Professor Davis's on Principles and Plans for Reorganizing Secondary Education; in its outspoken criticism of our educational shortcomings and its helpful constructiveness, the utterances of this chapter should sink deep into the minds of teachers. With a wide perspective of the whole field, here and abroad, it abounds in proposals of betterment that are capable of realization, if our communities realize the value of broadly trained teachers. We should exceed the limits of this review if we were to quote from the wealth of sound doctrine, incorporated in this one striking chapter. Next to it in importance among the initial five chapters is that of Professor Elliott on the Organization and Control of Instruction; exception, however, must be taken to what seems an unfortunate separation of *supervisory* from *inspectorial* control. The two are inseparable; inspection should be a constant accompaniment of supervision, a measurement of the results growing out of expert direction. To assign these two functions to two sets of officers is to deprive supervision of its ultimate test of efficiency; it introduces the danger of mechanical measurement of results, of which the teachers in our large high-school systems could reveal many a distressing tale. Barring this one defect, the chapter is admirable; it protests against the peril of transitory enthusiasms, against encroachment of non-technical administrative boards on the free exercise of expert insight; it advocates a training of the teacher not according to academic standards, but according to standards erected for secondary education, and puts the responsibility for this mistake upon the colleges, where it properly belongs; it demands that the selection of teachers inhere as a prerogative in the supervising officer. It is significant too that, distinguishing *identity* from *equality* of instruction, Elliott urges as of special importance the differentiation of the content and method of instruction of boys from those of girls. Turning now to the twenty chapters that bear upon individual subjects of the curriculum, it is in no invidious spirit that single ones are selected for special commendation; those that contain besides fertile discussions of method in their own particular field, suggestions of procedure from which teachers of other subjects may readily profit. No teacher of true professional spirit but will appreciate Karpinski's article on Mathematics, Chase's on History, Kester's on Physics, and, above all, Denney's on English. In the latter chapter in particular there are massed so many practical devices to render the teaching of English more effective (pp. 234–38) that one regrets the absence of similarly helpful suggestions in some of the other chapters; culled from a varied and rich experience, from a study of every promising method that has borne fruit, these comments of a successful teacher surpass in value all generalizations of theory. Not merely what to undertake, but how to do it, is what our inadequately trained teachers (and they are, alas! in the majority) need to know.

In the article on physics the question of the value and relation of laboratory work as an element, but not the sole element, in the secondary teaching of the subject is discussed with much sanity, and there is emphasized an urgent plea for the consideration of the historical evolution of physical science, a phase of the work to which the French attach much significance, but which we have been apt to slight. It was well worth while to include in the series of chapters discussions of sex pedagogy in the high school and of psychology in the high-school curriculum, though in the former case the difficulty of rational handling of the subject is made prominent, and in the latter, doubt as to the advisability of its introduction is obviously felt by the writer. As to psychology, your reviewer has no hesitation in advocating its exclusion from the high-school curriculum; the immaturity of high-school pupils calls for an emasculation of the subject that renders it valueless.

No greater praise can be accorded to the publication as a whole than that it is an epochal contribution to the library of the high-school teacher.

JULIUS SACHS

A Monograph of the Mycetozoa: A descriptive catalogue of the species in the Herbarium of the British Museum. By ARTHUR LISTER, F.R.S., F.L.S. Second edition, revised by GULIELMA LISTER, F.L.S. With two hundred and one plates and fifty-six wood cuts. London, printed by order of the Trustees of the British Museum. 1911. Octavo, 302 pp.

It marked an epoch in the study of these organisms when in 1894 Arthur Lister brought out an exhaustive monograph of the Mycetozoa based on the specimens in the British Museum. It was illustrated with seventy-eight plates of much more than usual merit, which proved invaluable aids to the student, as did also the illustrated keys to the genera which accompanied the "orders." Now, seventeen years later, and nearly four years after the author's death, a second edition is brought out by his daughter, who had aided him in the preparation of the first edition, as well as in the work undertaken in anticipation of the present edition. The result is a modernized and much augmented monograph, following, however, in the main the treatment given in the earlier volume. Some of the genera have been changed in their positions in the group, the most notable change of this kind being that by which *Lycogola* is moved from the Calonemineæ (with capillitium) to the Anemineæ (without true capillitium). In the new book families are still called "orders," in which one may discern the influence of the botanical nomenclature of the immediate English past. This appearance of botanical antiquity is shown also in the use of "Cohort" and "Sub-Cohort."

Comparing the two editions, one finds forty-nine genera in the new edition as against forty-three in the old, and two hundred and forty-six species in the new, to one hundred and seventy-six in the old. These numerical changes are mainly due to the very considerable increase of available material for study resulting from the widespread interest aroused by the publication of the first edition. Other changes which will be noted by the student of these organisms result in part from a better knowledge of their structure, and somewhat to the application of the laws of botanical nomenclature formulated in Vienna and Brussels, by which many names have been changed. For aid in this work cordial credit is given to Professor T. H. Macbride, the well-known American authority on the Mycetozoa.

Looking over the book, one is struck by the obvious mixing of botanical and zoological ideas. Nowhere in the book are the Mycetozoa spoken of as plants; nor on the contrary are they called animals. They are invariably called "organisms." Yet in the introductory chapter in connection with the statement that swarm-cells coalesce to form a plasmodium we are told that "in consequence of this discovery, which indicated a relationship with the lower forms of animal life, DeBary in 1858 introduced the name Mycetozoa." Yet the specimens on which the monograph is based are in the Herbarium of the British Museum, while the preface is written by A. B. Rendle, of the Department of Botany, and as has been said above the nomenclature has been revised in accordance with the laws of botanical nomenclature. Verily, it is difficult to break the traditions of even scientific men! If we were to take up the study of the Mycetozoa to-day for the first time it is certain that we should all agree that they are animals, but because they were thought to be plants for so long, it is difficult to transfer them from the plant kingdom to the animal.

And it must be confessed that the beauty of the spore-stage is so great that we can not blame the botanists for their unwillingness to let these pretty things escape from the botanical domain. There is also much the same feeling now among the myxomycologists that there was among the lichenologists thirty years ago when DeBarry and Schwendener and other botanical insurgents were saying that the lichens were fungi. And yet to-day the fungus nature of the lichens is conceded

by botanists the world over. So it will be with the Slime Moulds, that are "passing," to be replaced by the Slime Animals.

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SCIENTIFIC JOURNALS AND ARTICLES

THE May number (Vol. 18, No. 8) of the *Bulletin of the American Mathematical Society* contains the following papers: "Definite integrals containing a parameter," by D. C. Gillespie; "On the V_3^3 with five binodes of the second species in S_4," by S. Lefschetz; "What is mathematics" (review of Whitehead and Russell's "Principia Mathematica"), by J. B. Shaw; Review of Bianchi-Lukat's "Differentialgeometrie," by L. P. Eisenhart; "Notes"; "New Publications."

The June number of the *Bulletin* contains: Report of the April meeting of the Chicago Section, by H. E. Slaught; Report of the twenty-first regular meeting of the San Francisco Section, by T. M. Putnam; "Implicit functions defined by equations with vanishing Jacobian," by G. R. Clements; Review of Darwin's Scientific Papers, by E. W. Brown; Review of Pareto's "Manuel d'Economie politique," by E. B. Wilson; "Notes"; "New Publications."

SPECIAL ARTICLES

THE LAWS OF PHOTOELECTRIC ACTION AND THE UNITARY THEORY OF LIGHT (LICHT-QUANTEN THEORIE)

IN a note which was published in a recent number of SCIENCE (Vol. 35, p. 783, May 17, 1912) Dr. Karl T. Compton and the writer announced, as the result of experiments, certain conclusions they had come to regarding the relation between the number and kinetic energy of the electrons emitted by different metals under the influence of light, on the one hand, and the frequency of the light and the position of the metals in the voltaic series, on the other. The following brief outline of a method of deducing and extending these laws from theoretical considerations, is not without interest.

Let N_v be the number of electrons emitted in unit time by unit area of a metal in the presence of unit density of isotropic radiation of frequency between v and $v+dv$, let T_m represent the maximum kinetic energy of these electrons and T_v their mean kinetic energy. The writer[1] has shown that N_v and T_m have to satisfy equations which can be reduced to

$$\int_0^\infty N_v h v^3 e^{-hv/R\theta}\,dv = A_1\theta^2 e^{-w_0/R\theta} \qquad (1)$$

and

$$\int_0^\infty N_v T_m h v^3 e^{-hv/R\theta}\,dv = 2A_1 R\theta^3 e^{-w_0/R\theta}. \qquad (2)$$

In these equations h is Planck's radiation constant, A_1 is a constant characteristic of the material and independent of the temperature θ, w_0 is the internal latent heat of evaporation of one electron at the absolute zero and R is the gas constant reckoned for a single molecule. The following is a solution of equations (1) and (2):

$$N_v = 0, \text{ for } 0 < hv < w_0, \qquad (3)$$

$$N_v = \frac{A_1 h}{R^2 v^2}\left(1 - \frac{w_0}{hv}\right), \text{ for } w_0 < hv < \infty, \qquad (4)$$

$$T_m = hv - w_0, \text{ for } w_0 < hv < \infty. \qquad (5)$$

Equations (1) and (2) have to be slightly modified when reflection of the electrons is taken into account. The result does not appear to make any important difference in (3) and (4) but, instead of (5), we get

$$T_v = s(hv - w_0), \text{ for } w_0 < hv < \infty, \qquad (6)$$

where s is the ratio between the proportion of the incident energy which is absorbed, and the proportion of the incident matter (or electricity) which is absorbed, from the stream of electrons which returns to the body in a state of thermal equilibrium. It can be shown that s lies between zero and unity.

If we define v_0 by the equation $w_0 = hv_0$ it can easily be shown that the experimental results announced by Dr. Compton and the writer are confirmatory of equations (3), (5) and (6). One of the most interesting consequences of the theory is equation (4) which has not yet been tested by experiment.

[1] *Phys. Rev.*, Vol. 34, February and May, 1912; *Phil. Mag.*, Vol. 23, p. 615, 1912.

There do not at present appear to be any considerations, either of theory or fact, which would limit the applicability of these laws to the comparatively narrow field to which the term photoelectric effect is usually restricted. For instance, there is no apparent reason why they should not be applicable to the ionization produced by such radiations as the Röntgen and γ rays. Moreover the deduction makes no essential use of the fact that the particles have been supposed to be electrically charged; so that similar laws may be expected to characterize the reversible formation of gaseous chemical products under the influence of ætherial radiations.

There is one other point. Equations (1)–(6) have been derived without making use of the hypothesis that free radiant energy exists in the form of "Licht-quanten," unless this hypothesis implicitly underlies the assumptions: (*A*) that Planck's radiation formula is true, (*B*) that, *ceteris paribus*, the number of electrons emitted is proportional to the intensity of monochromatic radiation. Planck[2] has recently shown that the unitary view of the structure of light is not necessary to account for (*A*) and it has not yet been shown to be necessary to account for (*B*). It appears therefore that the confirmation of equations (3), (5) and (6) by experiment does not necessarily involve the acceptance of the unitary theory of light.

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THE CAPE LOBSTER

In noticing the peculiar history of the animal from the Cape of Good Hope, designated under this head, I wish both to correct an error, and at the same time to direct attention to a little known individuality among the higher crustacea.

In a review of Dr. Calman's volume, "The Life of the Crustacea,"[1] this much abused animal was thus referred to:

> We thought that this somewhat shadowy species had never recovered from the aspersions cast upon it by Professor Huxley.

Dr. Calman has kindly called my attention to the fact that the species is really a very substantial shadow, that its nebulous reputation disappeared some years ago, and that Huxley's remarks were not wholly justified in 1878, for the elder Milne Edwards had published a good figure of the animal as early as 1851. Indeed, as we shall see, his still earlier description was based upon an actual specimen.

In my first extended report upon the American lobster[2] the little Cape species was thus referred to:

> A third form, *H. capensis*, has been imperfectly described from the Cape of Good Hope, but it is doubtful if it belongs in this genus.

Such doubt as then existed has since been cleared up, and the species should have been included in my recent work on "The Natural History of the American Lobster."[3]

The facts regarding the literary history of this neglected species are briefly as follows: It was first figured and described by Herbst under the name of "The Cape Crayfish," *Cancer* (*Astacus*) *capensis*, in 1796,[4] and in a way to puzzle all future students who placed any confidence in his statements. Under the head of "The Cape Crayfish" was this brief description: "Museum Spengler. *Astacus*, slender, with smooth thorax; claws (manus), hairy, with crenate border; all the legs chelate"; followed by this even more vague and contradictory account:

> This beautiful crab (Krebs) occurs at the Cape in mountain streams. It is similar indeed to our common crayfish, but is more slender, and of equal

[1] See Science, N. S., Vol. XXXV., No. 892, February 2, 1912.

[2] *Ber. der. Deutsch. Physik. Ges.*, 1912.

[2] "The American Lobster: A Study of its Habits and Development," Bulletin of U. S. Fish Commission for 1895, p. 8.

[3] Bulletin of the Bureau of Fisheries, Vol. XXIX., Document No. 747, issued July 13, 1911.

[4] Johann Friedrich Wilhelm Herbst, "Versuch einer Naturgeschichte der Krabben u. Krebse, nebst einer systematischen Beschreibung Arten. B. 2, Krebse," Tab. XXVI., Fig. 1, and p. 49. Berlin u. Stralsund, 1796.

breadth throughout. It is coral red in color and has a beautiful sheen resembling the carnelian. Whether this is its natural color, or whether it is due to cooking, I can not decide. The appendages are relatively small. The base of the hand (carpus or fifth segment) nearly surpasses the arm (meros or fourth segment), and is strongly tuberculated; the hands are large, and are bordered, moreover, with a very delicately raised and toothed margin (Rande), studded everywhere with yellowish, transparent hairs. The feet are all chelate, while in the common crayfish the first pair only have this character.

This faulty description seems to have been drawn from an imperfect specimen, or with insufficient care, supplemented by incorrect data in regard to habit, and not very happy guesses in filling up the gaps of whatever sort.

Herbst's work was in a large measure a compilation, being at the same time a curious and interesting epitome of the life and lore of the Crustacea from the most ancient times. The numerous drawings which were in copperplate and colored by hand, are rather poor even for the period (particularly in this volume), when not copied from a master, like Roesel von Rosenhof. Any statements regarding the problematical Cape species need not have been taken too seriously, when of the common European lobster which had been known and eaten from antiquity, he stated in the same paragraph, that it carried its eggs under its tail, and laid them in the sand.[5]

As an illustration of another side of Herbst's work I give the following in free translation:

Crayfish, when kept in confinement are fed with beer daily, or with sweet milk, which is better, and of which they are very fond.

[5] "The pairing season (of the European lobster) begins in spring, and continues during most of the summer. Their fertility is uncommonly great; *12,444 eggs have been counted under the tail of a single lobster,* not to speak of those which still remained in the body. *They lay their eggs in the sand, where they are hatched by the sun.*" Italics mark this contradiction, which is the more singular from the fact that Roesel's figure of the crayfish's eggs attached to the swimmeret is reproduced. The last statement was probably copied from Pennant.

It is in this work also that we have a figure of the Pope's head in the lobster's stomach (Tab. 46, fig. 5), for as the writer says:

The middle and lateral teeth (of the gastric mill) give a striking impression, and may be likened to the Pope, seated in the choir with his cardinals (p. 205).

If the legs of Herbst's "Krebs" were all chelate, or if it lived in mountain streams, as Professor Huxley remarked,[6] it could be neither crayfish nor lobster, since in both there are but three pairs of chelate or double claw-bearing legs, and the lobsters were, so far as known, exclusively marine. On the other hand Milne Edwards at an early period rightly showed that Herbst's *Cancer* was a true lobster, and as such briefly described it in his "Natural History,"[7] under the name *Homarus capensis.* His description, now known to be correct, so far as it goes, was as follows:

Body slender; rostrum flattened, much shorter than the peduncles of outer antennæ, and finely toothed along its borders. Carpus granular; hands elongate, greatly compressed, garnished over their upper surface with a finely denticulate crest, and covered with hairs above. Length about 5 inches.

That this description was made from an actual specimen we have the testimony of Milne Edwards himself, who, as Stebbing remarks, placed after it in his "Natural History," the letters "*C. M.,*" which mean "those species which exist in the Museum of Natural History, where they will be found arranged in the same order as in this work." The drawing of the species, which as we have seen was published fifteen years later, excepting the crude figure of Herbst, remains the only one in existence to this day. Unfortunately Milne Edwards's figure appeared in a highly technical paper of a general character,[8] where it

[6] Huxley, T. H., "On the Classification and Distribution of the Crayfishes," *Proceedings of the Zoological Society of London,* pp. 752–788, London, 1878.

[7] "Histoire naturelle des Crustacés," T. 2, p. 335, Paris, 1837.

[8] "Observations sur le Squelette Tégumentaire des Crustacés Décapodes et sur la Morphologie de ces Animaux." Plate 11, fig. 1, *Ann. Sci. Nat. Zoologie,* Sér. 3, Vol. XV., Paris, 1851.

was inevitably overlooked, since this species was used merely as the exponent of the genus, and is referred to but once by name, and that under the description of the plate.[9] Huxley was no doubt familiar with this paper, but had he recognized the drawing, he would have certainly referred to it, and the "hopeless perplexity," to which he confessed "respecting the Crayfish or Lobster which is said to occur at the Cape of Good Hope, *Cancer* (*Astacus*) *capensis* of Herbst," would have been mitigated if not removed.

It is evident from the preceding account that the Cape of Good Hope lobster enjoyed a vague and uncertain literary reputation up to 1902 when it was redescribed by Stebbing[10] who gave the first full and accurate description of this interesting form from specimens furnished by Dr. Gilchrist.

The two specimens, a male and female, described by Stebbings, agree closely with the description of Milne Edwards. The serrated rostrum has no teeth on the lower side, and its apex extends beyond the base of the third segment of the first antenna.

A very interesting fact, but still commonly overlooked, is the periodic arrangement, in series of eight, of the spines of the toothed forceps of the European and American lobsters. Though less striking, the arrangement of the tubercles of the cracker claw is characteristic. So far as can be judged from Stebbings's description, these peculiarities are less marked or altogether wanting in the Cape lobster. Of the larger forceps he says:

> The marginal teeth are few and not bulky, hairs at the base of the thumb partly filling the cavity between it and the finger.

In the smaller claw there are said to be "many minute but unequal teeth, and a long brush of hairs."

In the American lobster the rostrum is serrate with fewer and larger teeth; there is usually a spine on its under side near the apex, which extends considerably beyond the third segment of the first antenna. In specimens from three to four inches long short hairs partially fill the cavity between finger and thumb of the larger claw, while the serial teeth of the toothed forceps are quite concealed by matted tufts of setæ, like round stub-brushes, set in rows. The outer margin of the thumb (propodus) carries at its tip a row of about 14 such brushes, made up often of a hundred or more sensory hairs. Moreover, the "lock" or toothed forceps has a locking device, by means of which the jaws when closed can not be moved laterally or strained either up or down; this is effected by a displaced "lock" spine, overlapping tips, and a reversal in the alignment of the teeth whereby they overlap, and do not interlock.[11] A corresponding reversal is seen in the alignment of the setæ, the denser row being uppermost in the thumb (propodus), and lowermost in the dactyl.

To conclude this account of the Cape lobster I quote from Stebbings:

> The color (so far as known), the small size, the pubescence of the body and claws, and the flattened hands of the front chelipeds, will sufficiently distinguish this neat little South African species, less than four inches long and less than three quarters of an inch broad, from the clumsier lobsters of the north.

At last the Cape lobster thus emerges as a true species, of small size and attractive appearance, and like its more famous relatives in Europe and America, it lives only in salt water. It is sincerely hoped that zoologists will not have to wait another half century for an adequate account of both its habits and development.

As if this form were doomed to confusion, Stebbings persists in using the term *Astacus* for the lobsters, but since the decision of the

[9] Singularly enough in my copy of this paper the last page bearing the name of the lobster is missing, though the description has been supplied in manuscript.

[10] "Marine Investigations in South Africa," Vol. 1, p. 34, Cape Town, 1902. See also Stebbing's "General Catalogue of South African Crustacea," *Annals of the South African Museum*, Vol. VI., p. 378, London, 1910; also Calman's review of the same, in *Nature*, Vol. 86, p. 174, April 6, 1911.

[11] See "Natural History of the American Lobster," p. 261.

International Commission on Nomenclature was rendered in August, 1910, in favor of restricting *Astacus* for the crayfishes and *Homarus* for the lobsters, it is hoped that this needless source of misunderstanding will be eventually removed.

FRANCIS H. HERRICK
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A PANUM INCUBATOR WITH IMPORTANT MODIFICATIONS

ONE of the most pressing needs of a general bacteriological laboratory is an incubator which possesses compartments of different but constant temperatures. Various types have been constructed and are in use to-day. After a rather extended investigation into the subject of incubators the writer chose the so-called "Panum" model with certain modifications. An admirable description of this incubator, together with certain improvements which it has undergone in the Carlsberg laboratory, is given in Klöcker's "Fermentation Organisms."[1] A brief description seems desirable here, in order to impress upon those who are not familiar with the apparatus its salient characteristics.

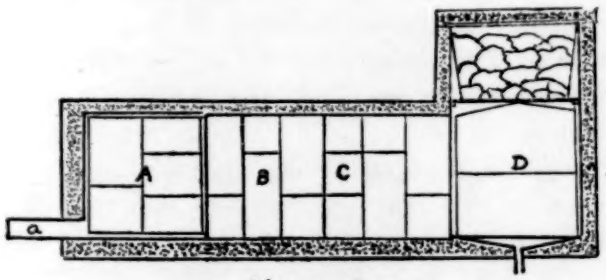


Fig. 1

The incubator consists of three main parts (Fig. 1, *A*, *B–C*, and *D*) which are constructed separately, preferably of thick sheet metal. These three parts are soldered together. The first compartment, *A*, is double-walled. The space between the two walls is filled with water, which is kept at the required temperature by a safety gas lamp which is controlled by a thermo-regulator (*b*). The gas lamp is placed under a projecting wing (*a*) of the outer metal wall. As this wing may burn through in the course of time it is connected with the water jacket by means of screws and flanges which are provided with rubber packing. The projecting wing may be replaced when necessary, without any difficulty. The space between the two walls of *A* is filled with water poured in through holes in the top. The water may be run off through a stopcock situated on the wing.

Compartment *A* is divided into halves by a vertical partition. Division *B–C* is divided into two compartments each of which is subdivided into three equal sections by vertical metal partitions. All of the divisions are provided with two shelves which may be placed at any desired height. The last main compartment, *D*, serves as a refrigerator. It possesses an inner receptacle, the roof of which slopes to the sides and back. This inner box is cooled by water which trickles down over it from ice which is held on a strong grating. The water is run off through an opening in the floor of the main compartment. The ice container is covered with a metal lid over which a thick wooden lid is made to fit closely.

The entire apparatus, with the exception of the front, is covered by a layer of felt 8 centimeters thick and enclosed in a wooden box.

In the words of the book, "Each of the spaces 1 to 8 is provided with a tightly fitting glass door, and doors of sheet iron are fitted on each of the four large compartments, *A*, *B*, *C* and *D*, which are closed tightly by pressing against rubber strips fitted on the partitions. Four corresponding doors, also fitting tightly, are attached to the wooden case, their inner sides being coated with woolen pads. All these doors are hinged below, and when opened and resting in a horizontal position on adjustable brackets may be used as tables."

In the particular incubator under consideration it seemed desirable to make a number of changes or improvements over the model just described. In the first place, heavy copper sheeting was used throughout the apparatus, with the view, of course, of making all the parts more permanent. Besides soldering the three separate divisions

[1] Published by Longmans, Green & Co., London and New York.

together, they were fastened together with bolts or rivets. This makes it impossible for the parts to draw apart and thus greatly reduce the efficiency of the entire incubator.

The greatest departure from the original was made in the construction of the doors. The large doors opening out on hinges at the bottom seemed highly objectionable from the standpoint of convenience for those who regularly make use of the apparatus. Instead of providing each of the four main compartments with two single doors, one set of double doors was fitted to each division. These doors are made of heavy copper sheeting, and are two-walled. They are about three inches thick, and are so constructed as to fit perfectly into the fronts of the respective compartments, and to come together in such a way as to allow of no appreciable diffusion of heat. They swing on hinges at the sides of the divisions. The hinges are firmly attached by a special device. The doors are made to close tightly by means of fasteners situated at the tops and bottoms. Besides the single pair of doors for each large division, each small compartment is provided with its own movable glass door, as in the original model. The two-walled thick outer door, which is filled with air space, makes a third door unnecessary.

The approximate dimensions of the incubator are as follows: Length (outside measurement), 8 feet and 9 inches; height (not including ice box), 2 feet and 9 inches; width, 2 feet and 6 inches. Inside measurements of individual compartments: Divisions in section *A*, each 11 inches wide and 23 inches high; separate compartments in sections *B* and *C*, 8 inches wide and 23 inches high; and the inner receptacle or box in the refrigerator division, 23 inches cube.

The incubator rests on a strong wooden stand which is 30 inches high. At the refrigerator end there is a specially constructed platform by means of which the ice carrier has easy access to the ice box. To further facilitate the replenishing of the ice supply, the outer lid of the ice box has attached to it a stout cord, to the further end of which a heavy iron weight is fastened. The cord passes over a pulley which is fixed to the ceiling of the room.

The apparatus has been in operation for almost a year, and has proved highly satisfactory. The temperatures in the different compartments have been practically constant, even when there were marked fluctuations in the temperature of the room. To obtain the maximum efficiency, however, the thermoregulator must be in good working condition, and the ice supply must be replenished at regular intervals. The incubator has been in operation during the warmest summer season as well as in the coldest winter months, with but very slight variations in the inner temperatures, except during a few days of last summer when the temperature of the room was far above blood heat.

Aside from tests made by myself frequently, a rather exhaustive investigation of the constancy of the temperature of the different compartments was made by certain members of the Yale biological department in connection with their determination of the temperature coefficient of the rate of reproduction of *Paramecium aurelia*.[1] The temperature in each compartment was recorded by a tube thermometer, a maximum and minimum registering thermometer, and in one chamber also by a thermograph. In their report of the investigation we find the following statements.

> The temperatures of the various compartments were not only kept practically constant, but, which is more important from the standpoint of these experiments, the very slight variations which occurred, appeared practically the same in all the compartments simultaneously.

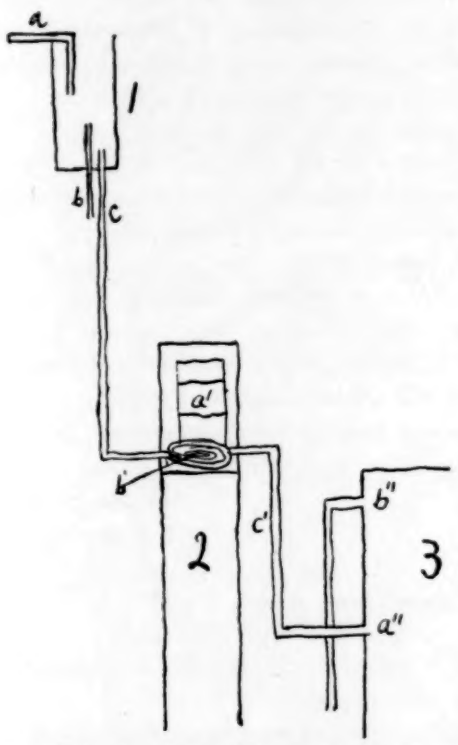
Leo F. Rettger
Yale University

A convenient 20° incubator

An incubator that will work satisfactorily with gelatin culture media during the hot summer and in our usually superheated laboratories in winter is a great desideratum. A number of expensive devices of this character

[1] Woodruff and Baitsell, *American Journal of Physiology*, XXIX., 147–155, 1911.

are on the market. The apparatus here described may be set up by any plumber at a very small expense—possession of refrigerator and incubator assumed.



(1) Small tank for constant head, about 1 ft. in each dimension. *a*, inflow; *b*, overflow; *c*, lead pipe. (2) Refrigerator. *a'*, ice; *b'*, flat coil under ice; *c'*, outflow to incubator. (3) Incubator. *a''*, cold water inflow; *b''*, overflow; thermometer and burner omitted.

The diagram explains the construction. The constant-head tank is placed 3–4 feet above the refrigerator. I have used ⅜ in. lead pipe with twelve turns under the ice (slightly larger would be better). With rather soft artificial ice the water flowing into the incubator has a temperature of about 14° C. The incubator temperature desired is, of course, determined by the thermo-regulator. I have been using a small Reichert regulator and natural gas. Under these rather unfavorable conditions I find a range of about 1° C. around 20° C. The results obtained in growing cultures have been entirely satisfactory during the past four years.

CHAS. B. MORREY
OHIO STATE UNIVERSITY

THE AMERICAN ASSOCIATION OF MUSEUMS

THE American Association of Museums held its seventh annual meeting in New York City from June 4 to 7. There was a large number of members in attendance and the convention may be considered in every way a success. Sessions were held at the American Museum of Natural History, the Metropolitan Museum of Art and the Museum of the Brooklyn Institute of Arts and Sciences. Addresses of welcome were made by Dr. Henry Fairfield Osborn, president of the American Museum of Natural History; Mr. Robert W. de Forest, secretary of the Metropolitan Museum of Art, and Mr. Edward L. Morris, acting curator-in-chief of the Museum of the Brooklyn Institute of Arts and Sciences, and the following papers were read:

"Notes on Russian Natural History Museums," by A. R. Crook.

"An Adaptation of the Goodyear Classification of the Fine Arts to the Dewey System of Numbering," by Laura M. Bragg.

"The Lasting Qualities of a Mounted Mammal Skin," by Robert H. Rockwell.

"The Preparation of Ecological Invertebrate Groups," by Roy W. Miner.

"Wild Life of the Far East," illustrated by motion pictures, by Cherry Kearton.

"The Value of Photographs and Transparencies as Adjuncts to Museum Exhibits," by Caroline L. Ransom.

"The Care and Classification of Photographs at the Metropolitan Museum of Art," by Ethel Pennell.

"The Function of a Museum," by Paul M. Rea.

"The Training of Museum Trustees," by Charles Louis Pollard.

"Boards of Trustees and the Executive Officers of Museums," by Henry L. Ward.

"Why is a Museum," by Chester L. Boone.

"Laboratory and Museum Shelving," by Milton J. Greenman.

"Conveniences in Installation," by C. F. Millspaugh.

"Glossary of Art Terms," by Henry W. Kent.

"The Local Flora Problem of a Small Museum," by Eva W. Magoon.

"The Possibilities of Botanical Exhibits," by E. L. Morris.

"The Duty of American Zoologists to Wild Life," by William T. Hornaday.

"Method of Exhibiting Insect Collections," by Frank C. Baker.

"Non-evaporating Mounts for Alcoholic Specimens," by Roy C. Miner.

"Some Experiments of a Small Museum," by Harold Madison.

"Lantern Slides in Geography Work," by Carlos E. Cummings.

"Circulation Cases for Mounted Birds," by Herbert E. Sargent.

The Round Table discussions included five topics, "The Insurance of Museum Collections," "The Classification of Specimens," "The Possibilities of Systematic Cooperation between Large and Small Museums," "An Exhibition to Show the Destruction of Wild Life and the Extermination of Species" and "The Handling of Classes in Exhibition Rooms."

A day was spent by the association at the Bronx, visiting both the Zoological Park and the Botanical Garden, and trips were made to the Museum for the Arts of Decoration at Cooper Union, the New York Aquarium, and the Children's Museum of the Brooklyn Institute. Many remained over Saturday in order to accept the invitation of the Staten Island Association of Arts and Sciences to inspect its museum and to see the island.

In executive session the council voted that it should be the policy of the association to deal with the principles of organization and administration of museums and with their problems of technique rather than with matters of art, history or science as such.

Balloting for officers for the year 1912–13 resulted in the election of Henry L. Ward, Public Museum of Milwaukee, for president; Benjamin Ives Gilman, Museum of Fine Arts, Boston, for first vice-president; Oliver C. Farrington, Field Museum, Chicago, second vice-president, and Professor G. S. Morse, Peabody Museum, Salem, and Professor William C. Mills, Ohio State Archeological and Historical Society, Columbus, Ohio, as councillors for the next three years. The secretary, Paul M. Rea, Charleston Museum; assistant secretary, Laura L. Weeks, Charleston Museum; and treasurer, Dr. W. P. Wilson, Philadelphia Museums, were reelected. The four councillors continuing in office are Frederic A. Lucas, Henry R. Howland, Frederick J. V. Skiff and Henry W. Kent.

The association will meet next year in Philadelphia.

Paul M. Rea,
Secretary

SOCIETIES AND ACADEMIES

TORREY BOTANICAL CLUB

The meeting of March 12, 1912, was held at the American Museum of Natural History at 8:15 P.M. The meeting was called to order by Dr. Z. S. Leonard in the absence of officers of the club. Mr. Sereno Stetson was appointed secretary pro tem. Twenty-five persons were present.

The paper of the evening consisted of an illustrated lecture by Dr. Marshall A. Howe on "Some Floral and Scenic Features of Cuba." Lantern-slide photographs were shown illustrating characteristic Cuban plant associations, particularly in the provinces of Oriente, Camagüey, Matangas and Pinar del Rio. Special attention was given to the numerous native palms of the island and to the cacti of the Guantanamo Bay region. The sugar, tobacco and fruit-growing industries of Cuba were also illustrated and commented upon.

Sereno Stetson,
Secretary pro tem.

The meeting of March 27, 1912, was held in the lecture room of the New York Botanical Garden at 3 P.M. Vice-president Barnhart presided. Forty persons were present.

The scientific program consisted of a lecture on "Organization of *Pediastrum* Colony," by Professor R. A. Harper. The lecture was illustrated with lantern slides.

The meeting of April 24, 1912, was held in the Laboratory of the New York Botanical Garden at 3:15 P.M., Dr. W. A. Murrill presiding. Fifteen persons were present.

The scientific program consisted of a paper on "Plant Hairs," by Dr. William Mansfield. The speaker exhibited a number of figures representing various types of plant hairs and showed how the four main types, simple, compound, septate and non-septate, could be made the basis of a key by which many species of plants could be identified.

The meeting of May 14, 1912, was held in the American Museum of Natural History at 8:15 P.M. President Burgess presided. Nine persons were present.

The scientific program consisted of an illustrated lecture on "Dr. Charles H. Shaw's Botanical Studies in the Selkirks," by Miss Caroline S. Romer.

B. O. Dodge,
Secretary